FINAL

HYDROLOGIC ANALYSIS REPORT

HATCHIE RIVER BASIN SPECIAL STUDY

TENNESSEE AND MISSISSIPPI

PREPARED BY

U.S. DEPARTMENT OF AGRICULTURE'S
SOIL CONSERVATION SERVICE
FOREST SERVICE

JULY 1986

HYDROLOGIC ANALYSIS REPORT

HATCHIE RIVER BASIN SPECIAL STUDY
TENNESSEE AND MISSISSIPPI

TABLE OF CONTENTS

INTRODUCTION

This hydrologic analysis report is one of three documents resulting from the Hatchie River Basin Special Study. It describes the hydraulic and hydrologic elements, methods and procedures used in establishing a workable mathematical model to evaluate the effects of completed Public Law 83-566 watershed projects on the main stream of the Hatchie River. The model can be used to evaluate such variables as duration of flooding, velocities of flood waters, and the depths and areas of flooding by flood frequencies, both before and after completion of Public Law 83-566 watershed projects.

A sediment transport analysis report covering the entire basin and an accelerated land treatment plan for the Tennessee portion of the basin were also developed as a part of the overall study. This study was authorized and conducted under the provisions of Public Law 83-566 by the Soil Conservation Service. Assisting with the study were the Tennessee Department of Conservation (study sponsor), the Economic Research Service, Forest Service, and numerous other Federal and state agencies and organizations.

The Hatchie River Basin Special Study was preceded by a United States Department of Agriculture (USDA) comprehensive river basin, Type IV study completed in 1971. The initial river basin study report emphasized that problems resulting from excessive erosion and sedimentation were the basin's most serious resource-related problems. It also recommended that a basin-wide accelerated land treatment plan be developed and implemented.

The Tennessee Department of Conservation organized an interagency task force in December 1975 to initiate implementation of a Hatchie Scenic River Project. This action was taken after the Tennessee portion of the Hatchie River was designated as a Class I Natural River by the Tennessee General Assembly. The task force, consisting of representatives from 13 concerned organizations and state and Federal agencies, recommended that studies be initiated to specifically assess erosion, sedimentation and flooding and to analyze the main stem impacts incurred and anticipated as a result of land and water management projects and activities.

The Commissioner of the Tennessee Department of Conservation requested in June 1977 that the Soil Conservation Service and other agencies of the USDA conduct a special river basin study of the Hatchie River Basin. The requested study was officially authorized in January 1982 after a plan for conducting the study was developed and approved in late 1981.

Several technical terms are used in this document that may be unfamiliar to some readers. Selected definitions are provided in the Glossary.

SUMMARY OF FINDINGS

Hydrologic analysis of the effect of authorized Public Law 83-566 watershed projects on flooding on the Hatchie River main stream was conducted using standard SCS hydraulic and hydrologic procedures.

The flood damage effects were compared between the proposed watershed projects and the conditions without projects. The 1982 National Resource Inventory data, special inventories and watershed data were used in flood routing an array of eight flood frequencies ranging from the 0.33-year frequency to the 100-year frequency. Release rates from Public Law 83-566 watershed plans were used for "with" watershed project conditions.

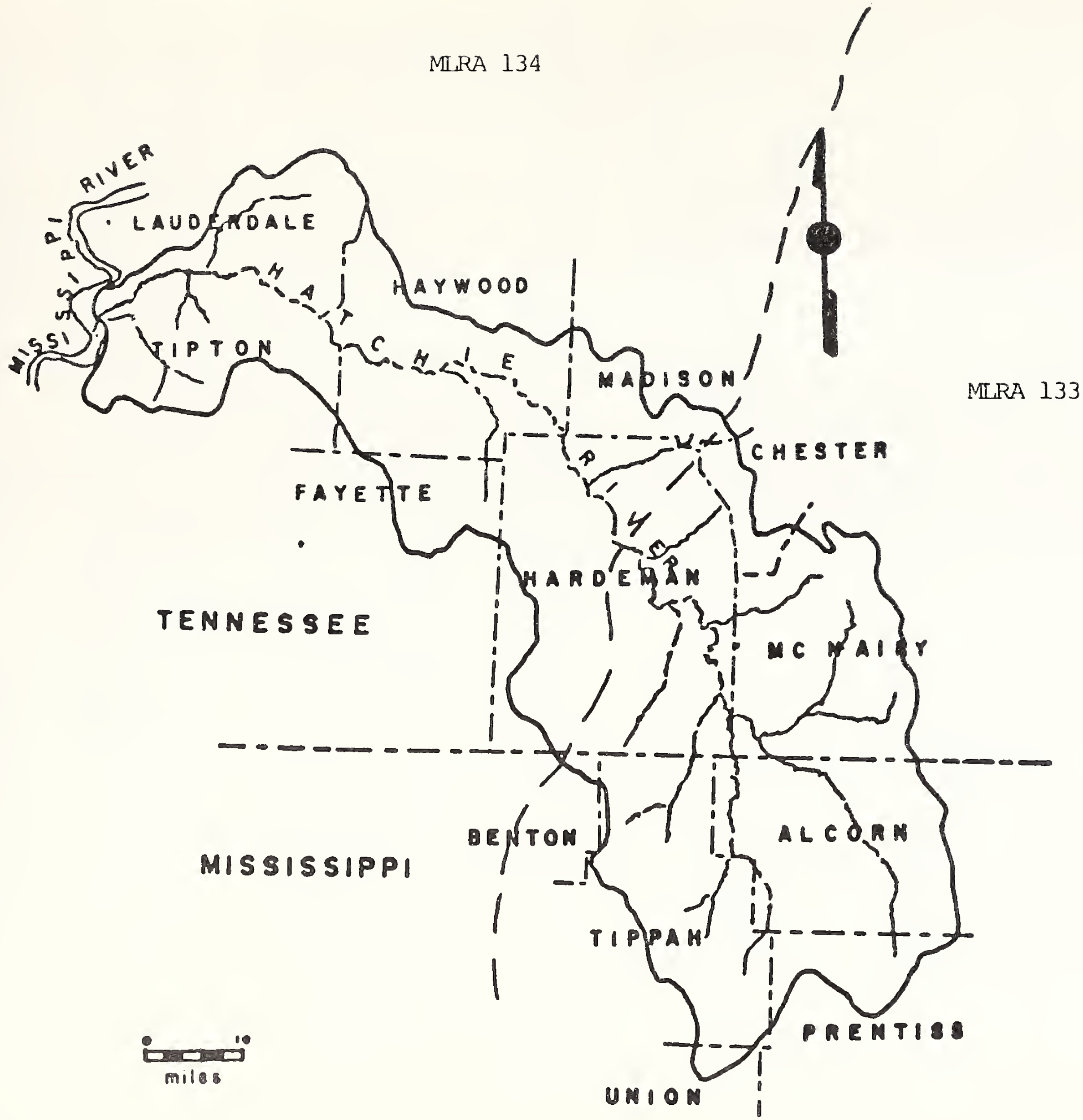
Installed and proposed Public Law 83-566 watershed projects reduce overbank flooding depths along the main stream of the Hatchie River by approximately 0.1 foot for the 0.33-year frequency flood, approximately 0.8 foot for the 5-year flood and an average of about 1.1 feet for the 100-year flood. These reductions are insignificant when compared to the total depth of overbank flooding. Total acres flooded are not significantly reduced. The duration of flooding increases along the entire main stream of the Hatchie River, but stream flow velocities are slightly decreased.

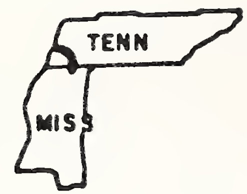
BASIN DESCRIPTION

The Hatchie River Basin is located in southwestern Tennessee and northern Mississippi. The river begins in Mississippi and is joined near the Tennessee-Mississippi state line by the Tuscumbia River. A total of 36 major creeks join the river as it flows from the state line northwesterly across Tennessee to its outlet at the Mississippi River, 35 miles north of Memphis. The drainage area is about 110 miles long and averages about 24 miles wide, with a total acreage of 1,664,600 acres. Twenty-eight percent of the basin is in Mississippi including parts of Alcorn, Benton, Prentiss, Tippah and Union Counties (General Location Map). In Tennessee, the basin includes parts of Chester, Fayette, Hardeman, Haywood, Lauderdale, Madison, McNairy and Tipton Counties. The basin lies within two major land resource areas (MLRA) (General Location Map). It is about equally divided between the Southern Mississippi Valley Silty Uplands (MLRA 134) and the Southern Coastal Plain (MLRA 133). The two areas are distinctly different in their resource characteristics. Sixty-five percent of the basin's forests occur in the MLRA 133, while 66 percent of the croplands and 57 percent of the pasturelands occur within MLRA 134.

Topography of MLRA 134 is a sharply dissected plain with a thick loess mantle underlain by unconsolidated sands, silts and clays of marine origin. MLRA 133 is a gently to strongly sloping dissected plain with the same underlying formations. Stream valleys are narrow in upstream reaches, but the lower parts of the valley are broad and have widely meandering stream channels.

The basin includes primarily two geologic physiographic provinces: the West Tennessee Uplands and the West Tennessee Plain. The eastern one-third of the basin lies within West Tennessee Uplands, which is dissected





GENERAL LOCATION MAP
HATCHIE RIVER BASIN
TENNESSEE AND MISSISSIPPI

and hilly, with some belts of rolling topography. Localized swamp conditions are present along many of the streams. Elevations range from 400 to 700 feet mean sea level. Most of the remainder of the basin lies within the West Tennessee Plain, which slopes gently westward from an elevation of 400 feet to 300 feet mean sea level. Topography is gently rolling, interrupted by small ridges and drainage divides. Some gullied topography has developed. Accelerated swampy conditions in the flood plain have resulted from erosion and the subsequent deposition of sediment.

The two physiographic provinces make up a portion of the eastern half of a larger geologic unit known as the Mississippi embayment of the Gulf of Mexico Coastal Plain. The Mississippi embayment now forms a trough filled with the old gulf sea sediments. The trough plunges to the south and follows the course of the Mississippi River. An arm of the gulf sea occupied the embayment for millions of years, and several thousand feet of sediment was deposited. Geologic units from Upper Cretaceous to Quaternary were deposited in the basin. Subsequent erosion has exposed these units. The formations consist primarily of gravel, sand, silt and clay. Windblown silt deposited in the Quaternary Age covers the western two-thirds of the area. The deposits of gravel and sand now form vast water-bearing aquifers, which produce large quantities of water.

The geologic formations strike north-northeast to south-southwest and dip to the west-southwest as shown on the geologic map (Appendix A). They are important in regard to the Hatchie Basin as several formations outcrop in the eastern one-third of the area and together with surface soils provide rapid rain infiltration. The result is several aquifers of abundant, high quality ground water supplies. Storm runoff is also reduced by this ground water infiltration.

The highly erosive nature of soils in the basin is directly related to soil formation from geologic materials. The following is a description of the general soil map units shown on the soils map (Appendix A):

1 - Memphis-Loring - This unit is mostly hills and ridges. The ridge-tops are narrow, winding and long. Crooked drains form deep, narrow valleys. The nearly level strips in the valleys are seldom more than 200 feet wide. The steep hillsides are most conspicuous. They have a slope range of 15 to 50 percent. The soils formed in deep silty deposits and are naturally fertile. Memphis soils are deep and well drained. Loring soils are moderately well drained and have a compact layer (fragipan) at a depth of approximately 28 inches.

About 80 percent of this unit is forest, and most of this is on the steeper slopes. The soils on the more gentle slopes are suited to a wide variety of crops. This unit has serious limitations for agriculture, because of the steep slopes and high erosion hazard of the soils. It has some limitations for residential and industrial development because of steep slopes.

2 - Grenada-Loring-Memphis - This unit is predominantly undulating to rolling. It consists of broad ridges that are gently sloping with strongly sloping side slopes and many small drainageways. The soils of this unit formed in silty deposits ranging from 5 to more than 20 feet

thick. The moderately well drained Grenada and Loring soils have a compact fragipan layer at a depth of about 24 inches except in severely eroded ares where the depth to the fragipan is 18 inches or less. Severe damage from past erosion is common on the more sloping parts of the unit that have been used intensively for crop production. Approximately 80 percent of this unit has been cleared and used primarily for field crops such as cotton, soybeans, corn, hay crops and small grain. Only a small part is in pasture or forest.

3 - Falaya-Waverly-Collins - This unit forms the alluvial flood plains of the Hatchie River and its tributaries. All of the soils are subject to flooding, most commonly in winter and spring. The soils are silty and fertile. The Falaya and Waverly soils are not too wet for growing corn and soybeans if drainage is provided. About 75 percent of this unit is forest and produces many species of trees. These soils are highly responsive to management and well suited for wetland wildlife habitat. They have serious limitations for housing developments and road construction because of flooding, low strength and wetness.

4 - Memphis-Loring-Lexington-Smithdale - This unit is moderately dissected with narrow gently sloping ridgetops; steep side slopes and narrow bottoms along the many drainageways. The Memphis, Loring and Lexington soils are on the ridges where they formed in silty materials that range from 3 to 6 feet thick over unconsolidated loamy sediments. The Smithdale soils developed in loamy sediments on the steep hillsides. These soils are all well drained except Loring, which is moderately well drained. Severely eroded areas and gullies are common in this unit, especially on the steeper slopes. The gently sloping ridges and narrow bottoms are suited for crops such as cotton, soybeans, corn and pasture. Many small severely eroded areas are idle or reverting to woodland. Most of the steeper slopes are forested.

5 - Ruston-Cuthbert-Providence - This unit is predominantly hilly, with long, rolling ridges; long, steep and very steep side slopes and narrow stream bottoms. Ruston and Cuthbert soils are well drained. Providence soils are moderately well drained with a fragipan layer about 24 inches below the surface. Providence soils are on the rolling ridgetops. Ruston soils are on the ridgetops and on the upper part of the slopes. Cuthbert soils commonly are on the lower part of the side slopes. The ridgetops and the stream bottoms are suited to corn, cotton and soybeans and are moderately productive for these crops. Many of the steep side slopes have never been cleared of trees. Some areas that were cleared and plowed now have deep gullies. Many of the side slopes that were cleared are reverting to trees.

6 - Wilcox-Dulac-Falkner - This unit consists of wide, nearly level ridges, short side slopes and narrow stream bottoms. The ridges are several miles long and are mostly one-eighth to one-half mile wide. The gradient of the side slopes between the ridges and the stream bottoms is generally less than 17 percent. The moderately well drained Dulac and somewhat poorly drained Falkner soils are on the ridgetops. They formed in a silty mantle 1.5 to 3 feet thick and the underlying clayey Coastal Plain sediment. The well drained Wilcox soils formed in clayey sediment

and are on the side slopes. Most of the unit has been cleared of trees and has been row cropped at some time. The ridgetops and the stream bottoms are suited to, and moderately productive for cotton, corn and soybeans. The steeper side slopes are not cultivated now and are reverting to trees. These soils have serious limitations for roads and buildings, because they shrink and swell with changes in moisture content.

The average annual rainfall over the basin is about 52 inches. October is the driest month, with an average of nearly 3 inches, and January is the wettest month averaging over 6 inches. About 59 percent of the annual rainfall occurs during the months of April through November. Generally, the winter rains are of several days in duration and extend over broad areas, but ordinarily the intensity is not severe. Rains of this type have caused the maximum floods to occur on the Hatchie River. Summer rains are usually of the thunderstorm type, with higher intensities, but cover smaller areas. Rains of this nature often cause flash flooding on tributaries of the Hatchie River. Monthly rainfall has ranged from a high of 19.4 inches in January 1937, to a low of 0.3 inches in September 1953. The average annual snowfall is approximately 4 inches. Snow seldom stays on the ground for more than a day or two at a time.

Agricultural lands, including forests, occupy 86 percent of the basin (approximately 1,430,780 acres). Of these, approximately 35 percent (504,690 acres) is cropland, 16 percent (230,010 acres) is grassland, and 49 percent (696,080 acres) is forest land. Other land occupies 14 percent (233,820 acres). Table A displays major land use for upland and bottomland by state.

TABLE A - MAJOR LAND USES BY UPLAND AND BOTTOMLAND

Hydrologic Analysis Report
Hatchie River Basin Special Study
Tennessee and Mississippi

Land Use	Upland			Bottomland			Basin Total
	Tennessee	Mississippi	Total	Tennessee	Mississippi	Total	
Cropland	337,870	96,840	434,710	48,720	21,260	69,980	504,690
Grassland	155,110	50,960	206,070	18,900	5,040	23,940	230,010
Forest Land	343,250	227,480	570,730	94,330	31,020	125,350	696,080
Other	159,970	22,530	182,500	36,920	14,400	51,320	233,820
Totals	996,200	397,810	1,394,010	198,870	71,720	270,590	1,664,600

Source: Soil Conservation Service Data

The forest land covers 42 percent of the basin. Eighty-two percent of the forest is in the upland, with the remaining 18 percent in the bottomland. The upland species include shortleaf and loblolly pine, red cedar, red and white oak groups, hickories, yellow poplar and sweetgum. The bottomland species are ash, cottonwood, black gum, tupelo and willow.

Forest and agricultural industries are important to the basin's economy. Numerous wood-using industries are located throughout the basin. Sawlogs, fuel wood and pulpwood are the primary forest products. Other products include veneer logs, poles, posts and miscellaneous industrial wood.

The most important row crops grown are soybeans, cotton, corn and wheat. Cattle, hogs, poultry, dairy and orchards are also important agricultural enterprises.

Population has fluctuated around 125,000 since 1930. The urban sector has almost tripled during this period. It is estimated that approximately 75,000 persons currently live in rural areas; and approximately 50,000 persons live in urban centers. Corinth, located in Alcorn County, Mississippi, is the basin's largest city. Other sizeable cities or towns include Selmer, Brownsville, Bolivar, Covington and Ripley, Tennessee.

COLLECTION OF BASIC DATA

Engineering field surveys were commenced by SCS personnel in January 1983 and completed in May 1983. These surveys consisted of 63 valley sections on the Hatchie River and 34 valley sections on tributaries. Additional valley sections surveyed during watershed project planning and construction activities were used along with surveyed sections on tributaries performed for the Hatchie River Basin Survey Report. Some valley section locations are shown on the Study Report Map in Appendix A. All surveys were referenced to mean sea level datum.

Valley sections on the Hatchie River varied in width from about 2,000 feet to approximately 16,000 feet. Sections on the tributaries varied in width from approximately 1,000 feet to 13,000 feet. Mannings "N" value or roughness coefficient for the valley and channel varied from section to section, but a composite value of 0.095 and 0.050 were used, respectively.

Valley sections were located on USGS quadrangle sheets, and distances were measured between each section for the channel length and valley length. The drainage area of each valley section was planimetered from USGS quadrangle maps and adjusted at various points of known drainage area.

Existing land use was determined from National Resource Inventory Data, from Mississippi State-Wide Cooperative River Basin Study Data and updated data from Public Law 83-566 watershed project plans.

Watershed work plans were used to establish release rates from planned floodwater retarding dams.

Rainfall data was obtained from U.S. Weather Bureau TP-49 for the various storm frequencies used in this study.

Rating curves (discharge vs. elevation) were obtained from U.S. Geological Survey (USGS) and U.S. Army Corps of Engineers existing stream gages.

PREVIOUS STUDIES

The U.S. Department of Agriculture's Soil Conservation Service (SCS), Forest Service (FS) and Economic Research Service (ERS), in cooperation with the Department of the Army, Corps of Engineers Memphis District completed and published the original Hatchie River Basin Survey Report in 1971. The report identified various tributaries of the Hatchie River that appeared feasible for flood control development under Public Law 83-566. Preliminary investigations showed 11 tributaries feasible for proposed watershed development during an early action program. Eighteen other

tributaries were identified as potentially feasible projects. No detailed hydrologic studies, however, were made of the Hatchie River as a part of the study completed in 1971.

Watersheds that have been studied since 1971 indicate that the potential for additional watershed flood prevention projects is very limited. Several watersheds, however, offer excellent potential for watershed protection projects.

Small portions of the Hatchie River have been studied in detail by the Memphis District Corps of Engineers, with study findings published as flood plain information reports. Stream segments that have been studied are generally located within the corporate limits of a city or town.

CURRENT WATERSHED DEVELOPMENTS

Eight Public Law 83-566 watershed projects have been approved for operations in the Hatchie Basin. These are displayed on the Study Report Map in Appendix A. Information regarding the projects is summarized below.

Major watershed problems identified are floodwater damages to crops, pastures, roads, bridges and minor fixed improvements with sediment damages to crops and pastures on flood plain lands. Watershed plans are designed to reduce or overcome these problems by: (1) conservation of agricultural land; (2) erosion control of gully, roadbank and other critically eroding areas; (3) and flood damage reductions by floodwater retarding dams and stream channel modifications.

The eight watershed projects when completed will control approximately 251 square miles (160,600 acres) of drainage area with 82 floodwater retarding dams. The drainage area controlled represents approximately 10 percent of the total basin uplands. Six of the eight projects are located in the upstream area or headwaters and have a more significant flood control and sediment trapping effect on the main stream. (See Study Report Map, Appendix A.) These projects reduce runoff from approximately 18 percent of the upland above VS-41 at Piney Creek.

HYDROLOGIC ANALYSIS

Two hydrologic conditions were evaluated. They were (1) Existing conditions without watershed projects installed and (2) Conditions with watershed projects installed. The National Resource Inventory (NRI) special inventories, Public Law 83-566 watershed data and the Mississippi State-Wide Cooperative River Basin Study were used to determine land use and soil-cover complex data. Forty-eight-hour rainfall data was taken from the U.S. Weather Bureau Technical Paper No. 49 (TP49) for the 100-, 20-, 10-, 5-, 2.33-, 2-, 1- and 0.33-year frequencies. Synthetic storm hydrographs were developed using a 48-hour distribution. These storm hydrographs were flood routed through the system using SCS Technical Release No. 20, A Computer Program for Project Formulation.

Accuracy of the hydrologic model was checked by comparing the routing of the 100-year storm in the evaluation against a plotting of the 100-year storm as prepared from: "Floods in Tennessee - Magnitude and Frequency" by C. T. Jenkins (TN), with favorable results. Ratings of surveyed valley

sections at Rialto, Bolivar and Pocahontas using the SCS - WSP 2 program were comparable to USGS or Corps of Engineers rating curves for the same locations.

The various storms were routed using inventory data as described and based on the assumption that no watershed projects were installed. The second condition was routed with the same storms and inventory data based on the assumption that all planned watershed projects were fully installed. The results of these analyses are shown on Table B. Flood depths for each condition and three selected flood frequencies are also shown on Figures 1 (100-year), 2 (10-year) and 3 (2.33-year) in Appendix B. Flood depths are only slightly reduced on the main stream for all floods with watershed projects installed. Acres flooded are not significantly reduced as a result of the watershed projects. The duration of flooding increases along the entire main stream of the Hatchie River, but stream flow velocities are slightly decreased (Table C).

CONCLUSIONS

The utilization of the model developed in this study shows that the eight authorized Public Law 83-566 watershed projects in the Hatchie Basin have only a slight influence in reducing flooding along the main stream of the Hatchie River. All eight projects combined reduce overbank floodwater levels from an average of only 0.1 foot for the 0.33-year year frequency flood up to an average of 1.1 feet for the 100-year flood. These reductions are relatively insignificant when compared to the total depth of overbank flooding.

There are several factors which influence the effectiveness of watershed projects in reducing down stream flooding. Watershed projects are basically designed to reduce flooding and provide benefits within project boundaries. In agricultural areas, projects are planned for flood reductions from smaller storm frequencies occurring during the cropping season. These projects rarely have significant effects downstream from the project boundary, even when effects are combined with other projects. The basic planning and design of watershed projects limit these downstream effects. Floodwater retarding dams are designed by SCS to automatically empty within 10 days of the largest designed storm; usually the 100-year frequency storm. This draw down feature is used in order to provide flood storage should subsequent storms occur. This protects the dam from overtopping and the emergency spillway from erosion from prolonged flow. To achieve these design features, high release rates are necessary, but must be compatible with channel capacity and flood reductions desired downstream. At some point downstream, the automatic release rates from all dams in a project combine with runoff from uncontrolled drainage areas. When these flows merge, there is little flood reduction downstream from this point. Projects are designed to extend this point as far downstream as possible.

The second significant factor affecting flood reductions on the Hatchie River main stream is the low percent of drainage area controlled by floodwater retarding structures. The 18 percent control at VS-41 (Piney Creek) is too low to significantly reduce main stream flood depths.

There are no plans to implement additional watershed projects in the basin with floodwater retarding dams. Therefore, a "what if" scenario of increasing the drainage control to 36 percent or 54 percent, etc. was not

TABLE 8 - DEPTHS OF FLOODING AND REDUCTIONS IN FEET BY SELECTED FLOOD FREQUENCY [1/]

Hydrologic Analysis Report
Hatchie River Basin
Tennessee and Mississippi

Valley Sections	100-Year			20-Year			10-Year			5-Year			2.33 Year			2-Year			1-Year			0.33-Year		
	NP [2/]	WP [3/]	R [4/]	NP	WP	R	NP	WP	R	NP	WP	R	NP	WP	R	NP	WP	R	NP	WP	R	NP	WP	R
147	5.1	5.1	0.0	4.2	4.2	0.0	3.7	3.7	0.0	3.2	3.2	0.0	2.7	2.7	0.0	2.6	2.6	0.0	2.3	2.3	0.0	1.7	1.7	0.0
53	15.6	13.4	2.2	12.0	10.6	1.4	10.7	9.3	1.4	9.0	8.0	1.0	7.7	6.6	1.1	7.2	6.4	0.8	5.7	5.1	0.6	2.8	2.6	0.2
45	11.8	10.1	1.7	8.9	7.8	1.2	7.8	6.7	1.1	6.7	5.7	1.0	5.4	4.6	0.8	5.2	4.4	0.8	3.9	3.5	0.4	1.8	1.7	0.1
41	11.2	9.9	1.3	8.9	8.0	0.9	8.1	7.8	0.3	7.0	6.2	0.8	6.0	5.4	0.6	5.8	5.2	0.6	4.8	4.4	0.4	2.9	2.8	0.1
40	11.4	10.0	1.4	9.0	8.0	1.0	8.1	7.2	0.9	7.2	6.3	0.9	6.0	5.2	0.8	5.8	5.1	0.7	4.6	4.2	0.4	2.8	2.7	0.1
37	7.8	6.7	1.1	5.9	5.1	0.8	5.2	4.4	0.8	4.3	3.6	0.7	3.4	2.9	0.5	3.2	2.8	0.4	2.4	2.0	0.4	0.6	0.4	0.2
34	7.5	6.5	1.0	6.2	5.1	1.1	5.5	4.4	1.1	4.3	3.7	0.6	3.5	3.1	0.4	3.4	2.9	0.5	2.5	2.2	0.3	1.4	1.3	0.1
31	8.8	7.6	1.2	6.8	6.0	0.8	6.0	5.2	0.8	5.2	4.3	0.9	4.1	3.5	0.6	3.9	3.4	0.5	2.9	2.6	0.3	1.2	1.1	0.1
30	7.5	6.5	1.0	5.7	4.9	0.8	4.9	4.2	0.7	4.1	3.5	0.6	3.2	2.8	0.4	3.1	2.6	0.5	2.3	1.9	0.4	0.7	0.6	0.1
29	8.0	7.1	0.9	6.4	5.7	0.7	5.7	5.0	0.7	5.0	4.4	0.6	4.1	3.5	0.6	3.9	3.3	0.6	2.8	2.3	0.5	0.6	0.5	0.1
28	7.3	6.4	0.9	5.6	4.9	0.7	4.9	4.3	0.6	4.3	3.7	0.6	3.5	2.9	0.6	3.3	2.8	0.5	2.4	2.1	0.3	1.2	1.0	0.2
24	7.0	6.1	0.9	5.3	4.4	0.9	4.4	3.6	0.8	3.5	2.8	0.7	2.5	1.9	0.6	2.3	1.7	0.6	1.7	0.7	0.6	-	-	-
21	9.5	8.6	0.9	7.8	7.0	0.8	6.9	6.1	0.8	6.0	5.3	0.7	5.0	4.5	0.5	4.9	4.3	0.6	3.9	3.7	0.2	2.5	2.5	0.0
18	10.6	9.5	1.1	8.4	7.4	1.0	7.3	6.4	0.9	6.3	5.4	0.9	5.1	4.3	0.8	4.8	4.1	0.7	3.5	3.0	0.5	1.4	1.4	0.0
12	13.8	13.2	0.6	12.4	11.7	0.7	11.6	10.6	1.0	10.4	9.5	0.9	9.0	8.2	0.8	8.7	8.0	0.7	7.3	6.8	0.5	4.4	4.4	0.0

1/ Depths of Flooding Above Top of Bank
2/ NP - No Projects
3/ WP - With Projects
4/ R - Reduction by Projects

TABLE C - DURATION OF FLOW AND DISCHARGE

(2.33-year Mean Annual Flood)

Hydrologic Analysis Report
Hatchie River Basin
Tennessee and Mississippi

Valley Sections		Duration of Flow NP 1/	Duration of Flow WP 2/	Discharge Per Foot of Channel Width NP	Discharge Per Foot of Channel Width WP
		----dd Sec 3/------		--------CFS------	
		-----1,000------			
135	Tuscumbia	599.4	972.0	6.2	44.0
147	McNairy Cypress	594.0	915.3	6.9	51.9
53	Upper Hatchie	702.0	915.3	5.3	47.8
50	Moses/Nail	729.0	918.0	6.2	58.1
51	Muddy	729.0	918.0	7.1	65.7
550	Grays	804.6	937.8	77.3	64.3
45	Porters	815.4	937.8	91.6	77.0
44	Cub	780.3	945.0	85.9	68.4
41	Piney	805.5	946.8	85.9	68.4
40	Spring	850.5	981.0	115.4	97.1
37	Gray's/Pleasant Run	895.5	1,071.0	89.5	72.7
35	Short/Mill	936.0	1,102.5	92.4	76.2
34	Clover	997.2	1,174.5	111.1	91.9
33	Hickory	1,044.0	1,201.5	62.8	53.6
31	Pinner	1,089.0	1,264.5	55.9	46.7
30	Jeffers	1,093.5	1,260.0	77.2	65.4
29	Shaw	1,170.0	1,372.5	70.8	58.3
28	Bear/Carter's	1,228.5	1,327.5	77.5	70.1
26	Sugar	1,237.5	1,413.0	96.7	82.8
24	--	1,237.5	1,368.0	53.4	47.2
22	Poplar	1,237.5	1,413.0	31.0	27.3
21	Muddy	1,309.5	1,468.8	87.9	76.7
20	Cypress	1,350.0	1,490.4	70.0	61.8
18	Lagoon/Camp	1,417.5	1,555.2	59.1	52.8
17	Williams	1,458.0	1,625.4	75.4	66.3
16	--	1,462.5	1,609.2	63.0	55.8
12	Henning	1,440.0	1,663.2	88.5	75.2

1/ NP - No Projects
2/ WP - With Projects
3/ dd Sec - Duration of flow in seconds for the 2.33-year flood hydrograph to pass through the selected reach

carried out. However, the depths of overbank flooding remaining with all present projects installed is still too large to be significantly reduced if greater control levels could be achieved.

The third significant factor influencing flood depths is the lack of channel capacity. Past and present sediment deposition, log jams and general debris all restrict channel capacity. As the channel continues to be filled and/or blocked, succeeding flood stages and areas of inundation increase. A particular flood frequency and equivalent conditions in 1986, consequently, will produce higher stages and flood a greater area of flood plain than the same flood would based on one in 1946. The same flood conditions in year 2026 will cause even greater flooding due to additional lost capacity. Flooding may not be the major problem 40 years hence, as swamping may be so prevalent as to change most of the Hatchie River Basin flood plain into a marsh condition, with only remnants of the present bottomland hardwood timber remaining.

REFERENCES

1. Hatchie River Basin Survey Report, Tennessee and Mississippi, U.S. Department of Agriculture, 1970.

2. U.S. Department of the Interior, Geological Survey, Water Supply Papers 1936 - 1982.

3. U.S. Department of Commerce, Weather Bureau, Technical Paper No. 49, 2 to 10-day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States, U.S. Government Printing Office, Washington, D.C., 1964.

4. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 20, Computer Program Project Formulation.

5. U.S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section IV Hydrology, U.S. Government Printing Office, Washington, D.C., August 1972.

6. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 61, WSP2 Computer Program, Engineering Division, Washington, D.C., May 1976.

7. U.S. Bureau of the Census, Census of Population 1970, Characteristics of the Population, Tennessee.

8. State of Tennessee, Department of Highways

GLOSSARY

Antecedent Moisture Condition (AMC) -- The degree of wetness or percent moisture in the soil profile at the beginning of a storm.

Aquifers -- An underground geologic formation that is porous and contains water.

Drawdown Time -- For purposes of this report, this is the time required to reduce floodwater storage from a maximum to a minimum volume.

Flood Routing -- Determining the changes in a flood wave as it moves downstream through a valley. Graphic or numerical methods are used.

Flood Frequency -- An expression of how often a flood of given magnitude can be expected. (Note: the word "frequency" often is omitted to avoid monotonous repetition.) Examples:

10-year flood or 10-year frequency flood - The flood which can be expected to be equaled or exceeded on an average of one in 10 years and which would have a 10 percent chance of being equaled or exceeded in any given year.
50-year flood - ... two percent chance ... in any given year.
100-year flood- ... one percent chance ... in any given year.
500-year flood- ... two-tenths percent chance ... in any given year.

Forty Eight (48) Hours Duration -- A selected design storm with a given rainfall amount, areal and time distribution used to estimate runoff.

Mannings "N" Value -- An estimated roughness value assigned to channels and used as a coefficient of roughness in a formula for estimating the capacity of a channel to convey water.

Percent Control -- The percent of watershed areas draining into and regulated by floodwater retarding dams. Compared to the total watershed area.

Public Law 83-566 -- The Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended, provides technical and financial assistance to state or local organizations in planning, designing and installing watershed improvement works. It provides cost sharing for flood prevention, irrigation, drainage, land treatment, fish and wildlife developments and public recreation. It also extends long-term credit to help local interests with their share of the costs, including costs of developing municipal and industrial water supplies.

Ratings -- A plotted curve showing elevations for a range of discharges at a surveyed cross section, stream gage or other selected point on a stream.

TR-20 Program -- A Soil Conservation Service computer program presented in Technical Release No. 20. Flood flow frequency curves are developed by flood routing various storm frequencies through hydrologic stream reaches.

U.S.G.S. -- United States Department of Interior Geological Survey is routinely engaged in flood studies and obtaining stream flow records with automated stream gage systems.

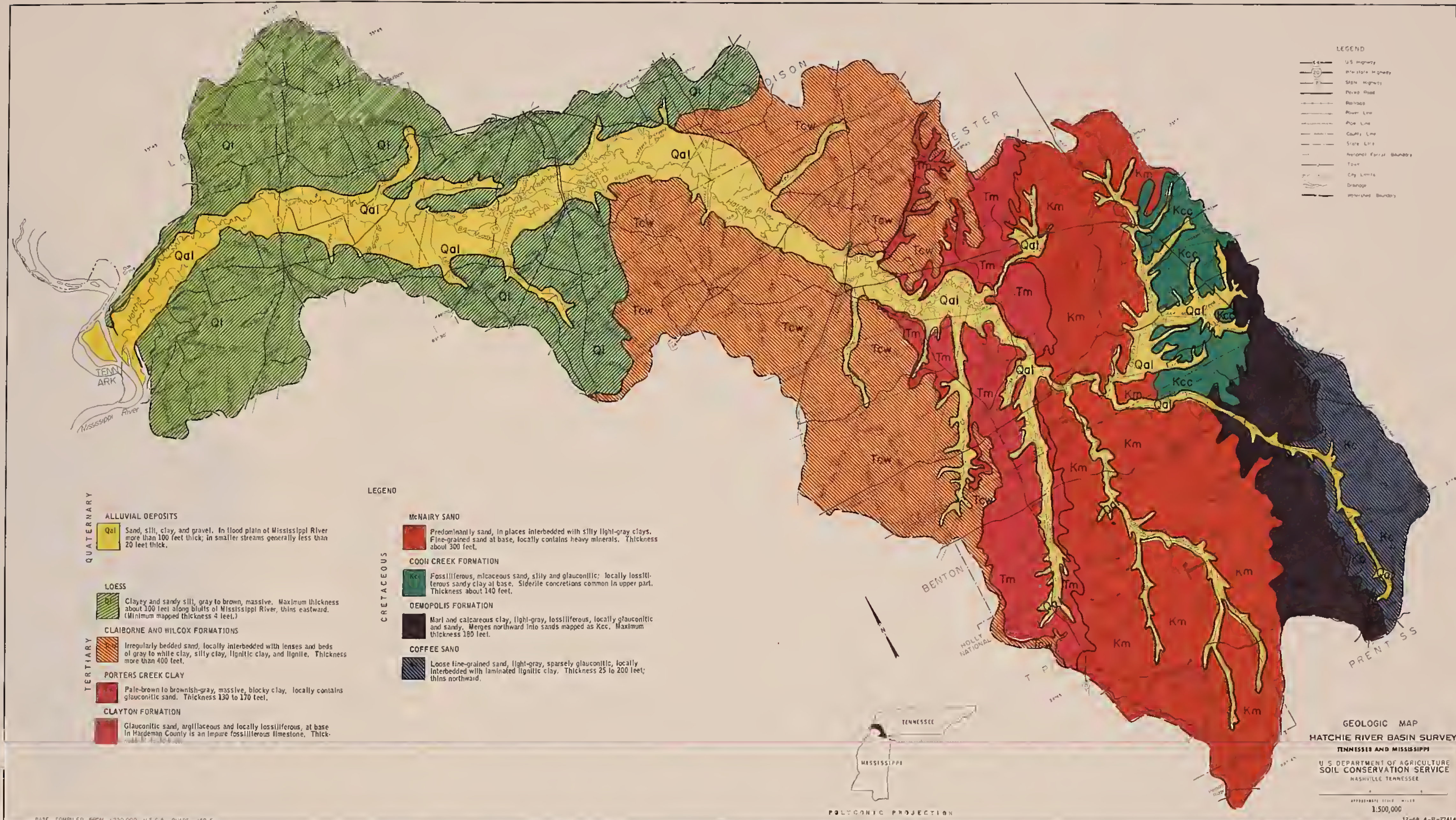
Valley Sections -- For purposes of this study, these are surveyed lines across a stream valley and channel and referenced to mean sea level (MSL).

WSP 2 -- A Soil Conservation Service computer program for developing profiles of the water surface throughout a stream reach for a various range of discharges.

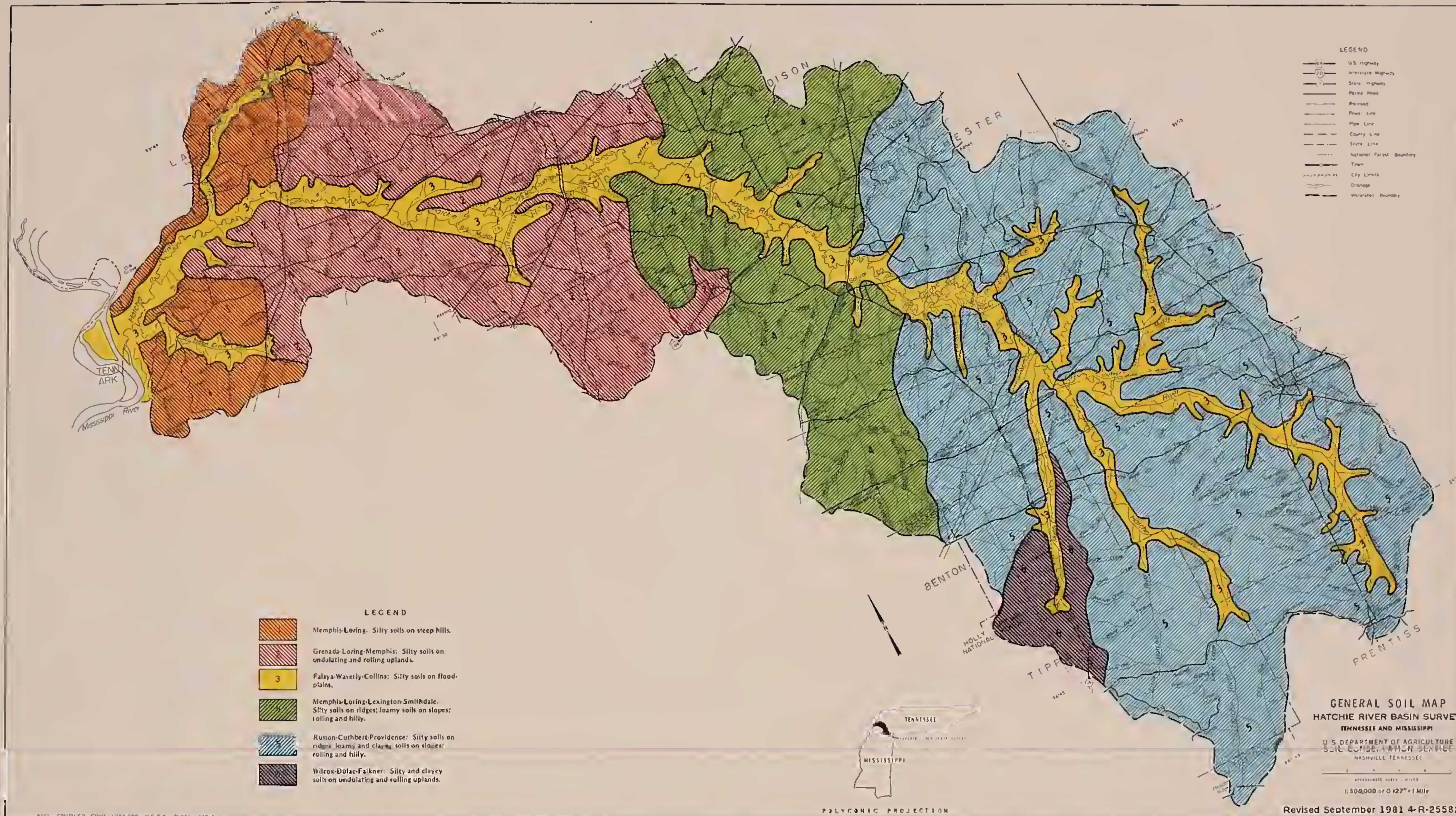
APPENDICES

APPENDIX A

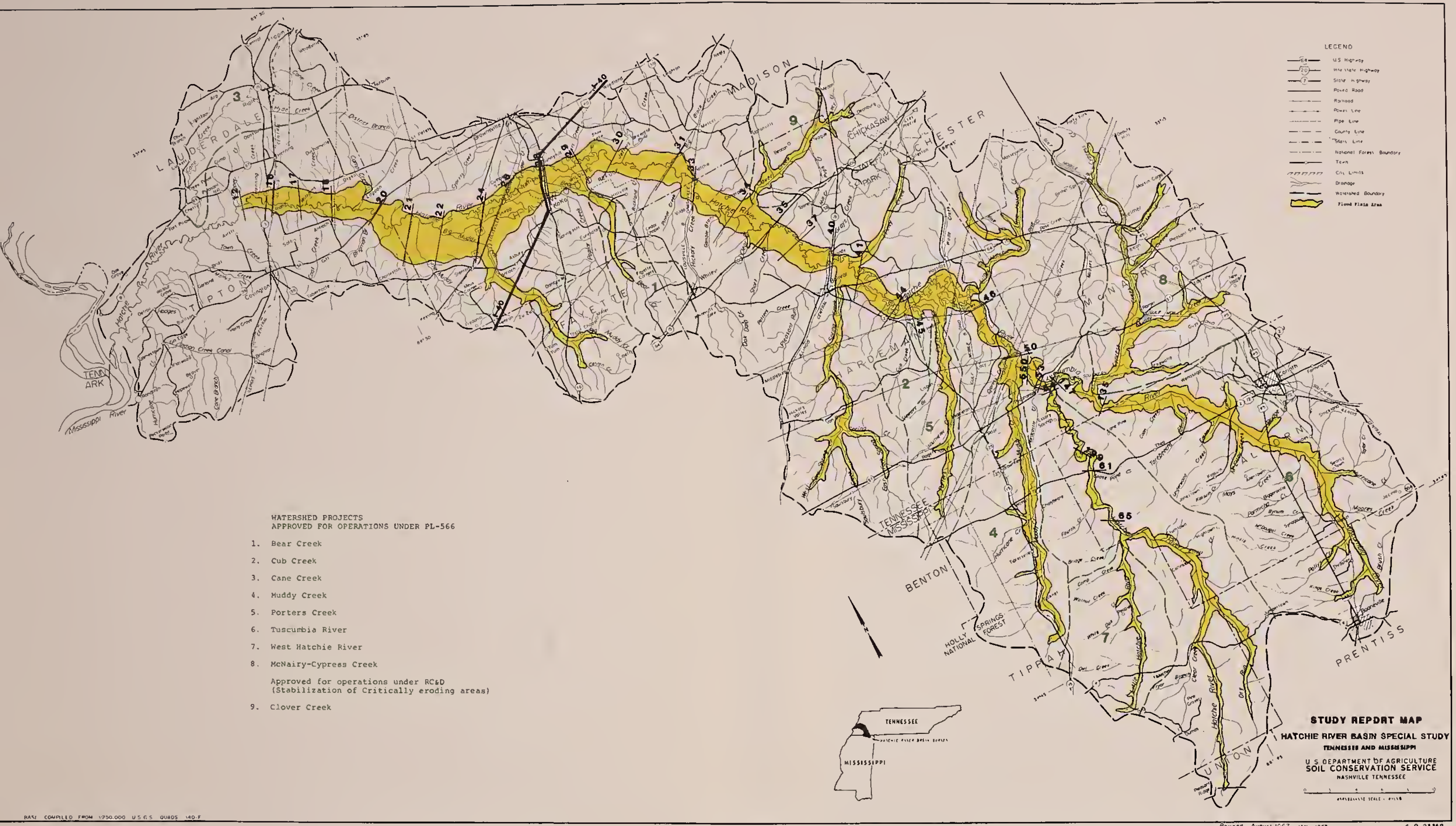
MAPS



USDA-SCS-FORT WORTH TEXAS 1981



USDA SCS-FORT WORTH TEXAS 1981



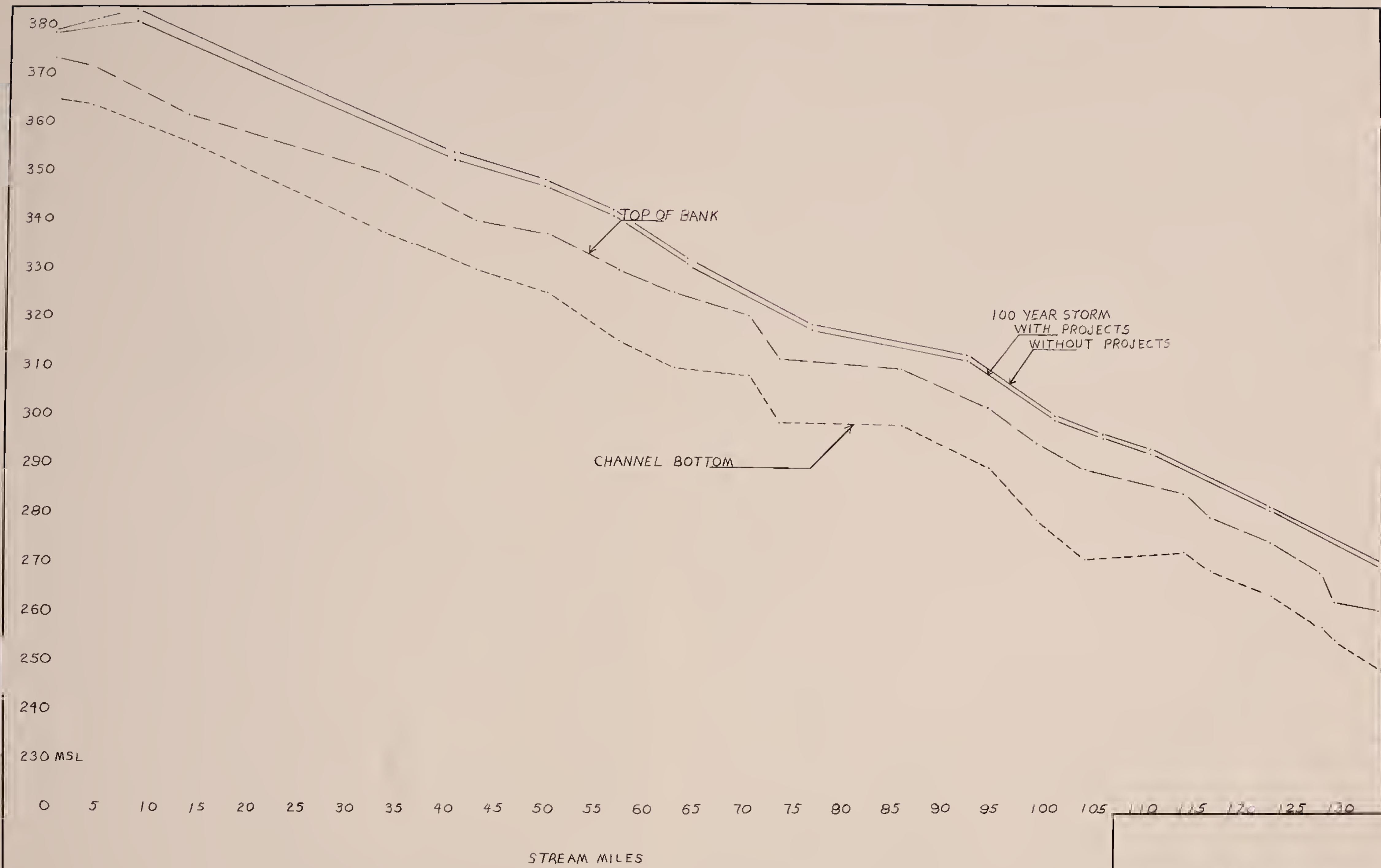
BASE COMPILED FROM 1:250,000 U.S.G.S. QUADS 140-F

Revised August 1967 JAN 1967

4-R-23358

APPENDIX B

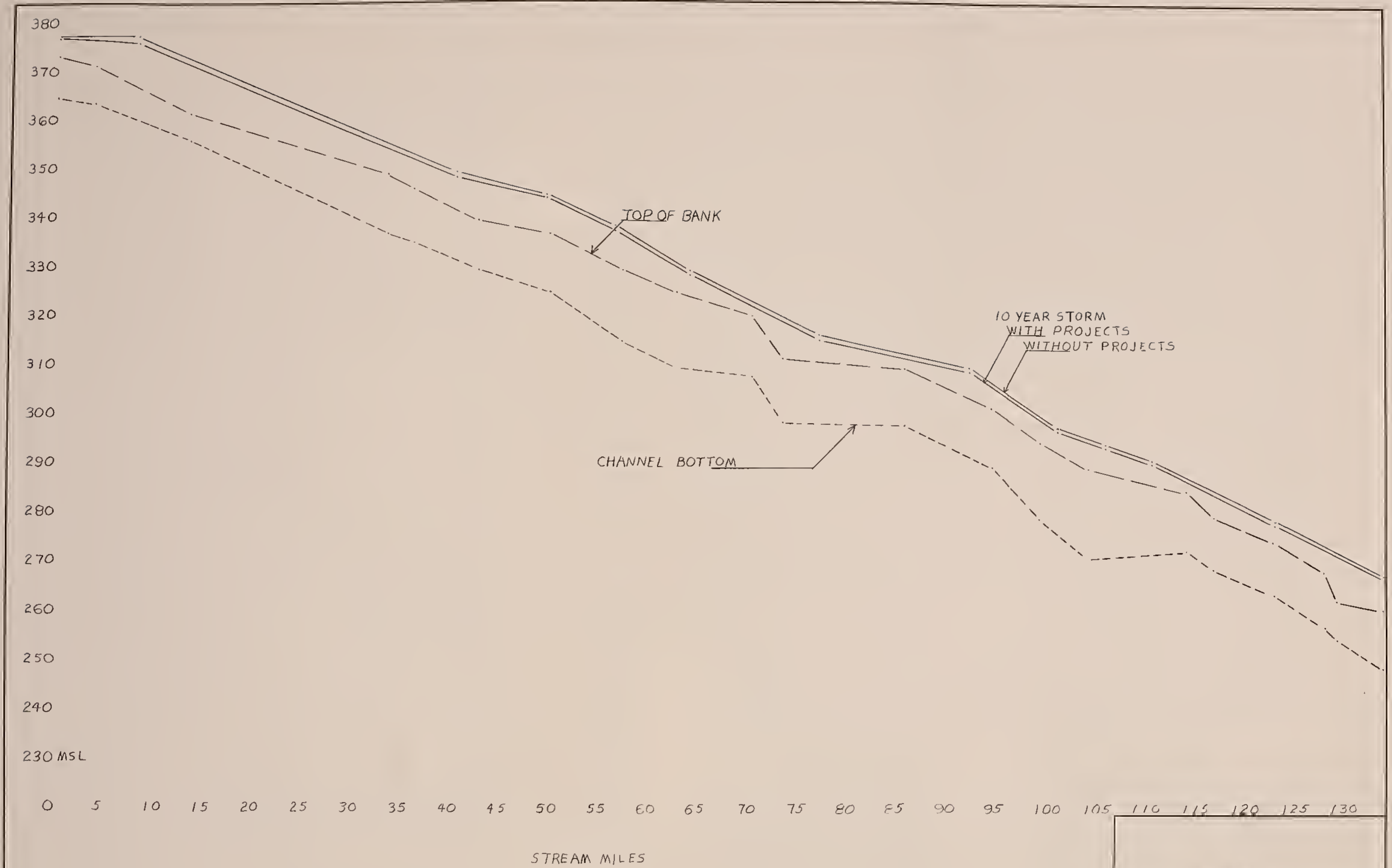
SUPPORTING DATA



HATCHIE SPECIAL STUDY

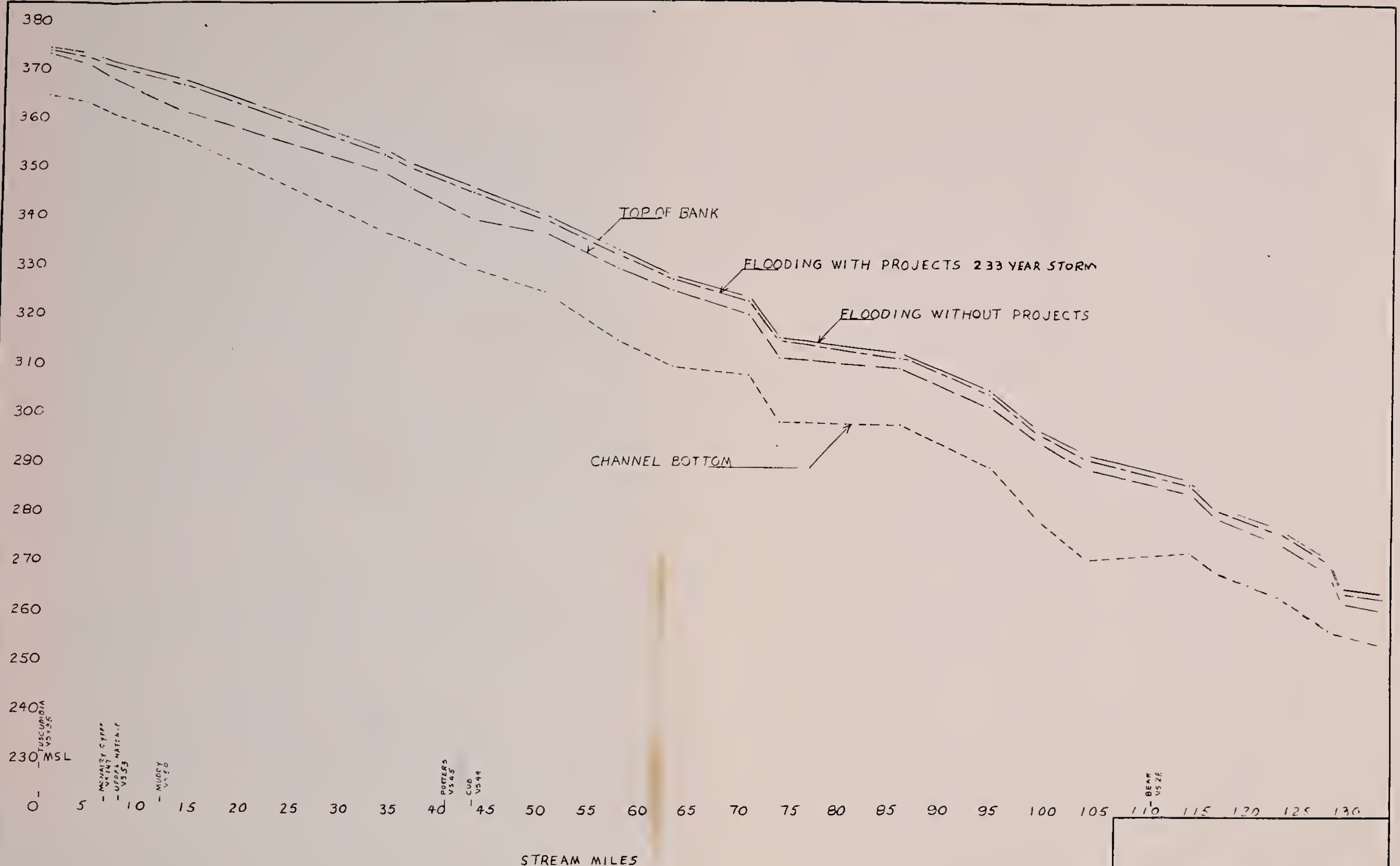
CHANNEL PROFILE

FIGURE 1



HATCHIE SPECIAL STUDY
CHANNEL PROFILE
FIGURE 2

SCS-ENG-313-B Rev. 10-75



HATCHIE SPECIAL STUDY
CHANNEL PROFILE
FIGURE 3